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Ueber optische Bewegungsempfindungen. Prof. SIGMUND EXNER. Biol.-
ogisches Centrablatt, 15 September, 1888.

In this lecture, Prof. Exner brings together so many interesting observations upon a topic to which he has largely contributed, that a somewhat detailed abstract will be desirable.

He begins by introducing into the sensation of motions a distinction between the inference of the motion of a body from the fact of seeing the body in different regions of space at successive intervals, and the immediate perception of motion as a simple elementary sensation. The distinction comes to the front in the observation, originally due to Czermak, that the second-hand of a watch, if observed in indirect vision, seems to move very much more slowly than when directly viewed. But Prof. Exner thinks that in the former case the motion is not perceived, but inferred; in the latter it is directly perceived. To show that it is not necessary for a perception of motion to have the object seen in two successive positions, one need only have the space between the two points, or the interval between the two appearances, so minute that they cannot be distinguished, and yet have a sensation of motion as the result. Under certain conditions two impressions succeeding another with an interval of .045 second are just recognized as distinct in time; but the *direction* of the motion of a light under the same conditions can be perceived when the interval between the beginning and end of the motion is only .014 second. But one can reduce the distance so that the beginning and end of the motion are no longer distinguishable. This is especially easy on the lateral portions of the retina, where one finds that two disks so near together as not to be seen as two, are none the less seen to move with the slightest motion, the lateral portions of the retina being very sensitive to motor sensations. If a row of dots be viewed away off in indirect vision, the number or distances of the dots will not be seen, yet the addition or removal of a dot will be noticed instantly.

This sensation of motion as distinguished from the inference of motion has a lower limit. Aubert found that a motion slower than 1° – 2° per second is not felt, which amounts to about a distance of 6–7 cones on the retina. Like ordinary sensations, these motor impressions leave an after-image. If a disk upon which a spiral is drawn be rotated, one will get the impression of a point moving towards the centre; if the disk be suddenly stopped, one sees a motion in the opposite direction. So, too, if after viewing such a rotating disk one casts the eyes on any object, that object, or that portion of it falling on the portion of the retina formerly stimulated, will be distorted, showing that these effects are retinal and not motor. If one views a disk with marked sectors rotating slowly, through a rotating disk with sectors cut out, one can so regulate the speed of rotation that the black sectors will not seem to be moving at all, being thrown back by the after-image upon the interruption of the sensation in the other disk.

That the after-image is confined to the portion of the retina formerly stimulated is shown by Dvorak, who had the different portions of his spiral rotating in different directions, and obtained an after-image corresponding to this difference. So, too, Fleischl found that after obtaining an after-image of a point moving horizontally, the projection of it on a series of vertical lines extended only as far as the original motion.

What will be the result if the two eyes have different motor-sensations? If you regard a rotating disk directly with one eye, and through a reversion prism with the other, you see opposite directions of rotation with the two eyes, giving rise to an uneasy feeling and no distinct after-image. If you close one eye you get its appropriate after-image. But most curious of all, if you look at the disk with one eye until fatigued, then close and look at a white surface with the *other* eye, you will see an after-image of the disk rotating in an opposite direction.

This holds equally well for the third dimension. A wheel rotating in the median plane is seen in the third dimension, and when suddenly stopped, the after-image is also seen in perspective. But this is obtained by a combination of the different after-images of the two eyes. A true after-image in the third dimension is not obtained. In the after-image only that portion of the nervous system is involved that aids in the perception of the adjacency of space impressions. In riding in the rear car of a train and looking backwards we see objects hurrying away from us. If the train stops we seem to be approaching the objects. In the former case the retinal impressions gradually grew smaller; now they by the after effect grow larger, and thus lead to the inference of our approaching them.

Again, it is found that if there is no stationary object in the field of vision, the minimum perceptible rate of motion is much raised; the threshold for motion becomes 10 times as high. It makes a difference whether the object moves across the retina or the eye follows the object across the field of vision; in the latter case the motion seems only about half as rapid as in the other. We have a more accurate notion of the motion of images on the retina resulting from the viewing of a stationary object while the eyes move, than we have of the motion of the eye muscles. If there is no object in the field of vision recognized as stationary, the perception of motion becomes vague; so in a dark room the movement of a light could hardly be seen.

We distinguish then between a sensation of motion which is immediate and is probably a subcortical function, and the conscious perception of motion by inference from various sensations.

Experimentelle Untersuchungen zur Amblyopiefrage. Dr. F. C. MÜLLER-LYER. Arch. f. Anat. u. Phys. 1887, p. 400.

Setting out with the idea of studying the phenomena of sight disturbed by disease, by studying normal sight as disturbed by experimental conditions, the author of this lucid article investigated four points, namely, (1) discriminative sensibility, (2) sharpness of vision, (3) color-sense, and (4) extent of the field of vision toward the periphery, in the three following conditions: (a) Simple weakness, (b) state of stimulation, (c) state following stimulation. Simple weakness of the eye can be paralleled for experiment by weakening the stimulus. The study of the first point under this condition is simply a retesting of Weber's law. After a set of careful experiments, the author found, as others have done, that Weber's law is not strictly exact. The discriminative sensibility is not constant, but depends on the intensity of the stimulus. The nearest mathematical expression for it (and that only an approximation) is that the former varies as the cube root of the latter. The second point was